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Anmelder/Applicant/Demandeur/Patentinhaber/Proprietor/Titulaire
ALCATEL

COMMUNICATION

The European Patent Office herewith transmits as an enclosure the European search report for the above-mentioned European patent application.

If applicable, copies of the documents cited in the European search report are attached.

☐ Additional set(s) of copies of the documents cited in the European search report is (are) enclosed as well.

The following specifications given by the applicant have been approved by the Search Division:

☐ abstract ☐ title

☒ The abstract was modified by the Search Division and the definitive text is attached to this communication.

The following figure will be published together with the abstract: 4

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REFUND OF THE SEARCH FEE

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 36 0213

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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X	WO 01 50278 A (APPSPOINT) 12 July 2001 (2001-07-12) * abstract * * figures 1A,6-8 * * page 3, line 3-16 * * page 11, line 19 - page 12, line 15 * * page 19, line 8-32 * * page 20, line 13-33 * ---	2,6,7,9, 10,12 ✓	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	18 December 2002	Gabriel, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 36 0213

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	18 December 2002	Gabriel, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 36 0213

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18-12-2002

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ABSTRACT / ZUSAMMENFASSUNG / ABREGE

02360213.9

The invention relates to observing requests, deriving quality of service (QoS) demands and scheduling the network's resources in terms of QoS. A scheduler is modulating the QoS based on service usage and user-behavior ("surf","chat","movie","ftp") just-in-time. It relates to a method for efficient use of network resources by just-in-time modulation of quality of service based on real-time service-usage and user-behavior ("surf","chat","movie","ftp") comprising steps recording events, generating a synthesis of user-behavior for a QoS user profile according to QoS user preferences, predicting required QoS demand based on current user behavior and user Qos profile, according to QoS user preferences, deriving and propagating QoS demands and allocations, and co-ordination of QoS request of a manifold of users, based on requests, QoS user profiles, QoS user preferences and resources. Further it relates to Computer Software Product, Client Terminals, a Scheduler server, a Network Element, and a Network.

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Bescheinigung | Certificate | Attestation

Die angehefteten Unterlagen stimmen mit der ursprünglich eingereichten Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.

The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

02360213.9

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

R C van Dijk

DEN HAAG, DEN
THE HAGUE, 12/08/02
LA HAYE, LE

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Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

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Demande n°: 02360213.9

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Date of filing:
Date de dépôt: 17/07/02

Anmelder:
Applicant(s):
Demandeur(s):
ALCATEL
75008 Paris
FRANCE

Bezeichnung der Erfindung:
Title of the invention:
Titre de l'invention:
Method computer software products,client terminal network element and network for efficient use of network resources by just-in-time modulation of quality of service based on service usage and user behavior

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

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Internationale Patentklassifikation:
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Bemerkungen:
Remarks:
Remarques:

METHOD, COMPUTER SOFTWARE PRODUCTS, CLIENT TERMINAL, NETWORK ELEMENT AND NETWORK FOR EFFICIENT USE OF NETWORK RESOURCES BY JUST-IN-TIME MODULATION OF QUALITY OF SERVICE BASED ON SERVICE-USAGE AND USER-BEHAVIOR

BACKGROUND OF THE INVENTION

Fi ld of the Invention

The present invention relates to modulation of quality of service (QoS) in access networks.

Background

Many sophisticated emerging applications, such as video streams, multimedia conferencing, or distributed virtual reality deploy in todays internetworking infrastructure. The main due requirement that all these applications share is the need for guaranteed quality of service (QoS) such as high bandwidth, delay, and jitter delay etc.

The ITU-T E.800 (08/94) recommendation introduces into the QoS concept on page 1 to 4 and defines there areas that affect the QoS. This recommendation describes factors that contribute collectively to the overall quality of service as perceived by the user of a telecommunication service. The users degree of satisfaction of the quality of service can be divided into service performance areas like support, operability, serveability, and security. It defines QoS as the collective effect of service performance which determine the degree of satisfaction of a user of the service.

Service providers that offer services with a guaranteed quality require management systems that can retrieve, calculate and present QoS data from the four performance areas. These management systems have to control the Service Level Agreements (SLA), between the consumers and the provider, and react on service quality violations according to business rules. Today there exist products to manage this, but no standards or de-facto standards exist to facilitate the integration of a QoS management system with other management

systems such as mediation, billing and service activation as part of a total management solution.

The QoS requirements are typically specified in terms of bounds, e.g., the worst case end-to-end delay or the maximum bandwidth. Other parameters may be specified as well.

On the other hand the networks have limited resources with respect to quality of service. The resources are shared between consumers.

Today the resources are allocated statically by consumers, e.g. according to a business model. There are colored services (gold, silver, bronze) available, where per connection at connection set-up a static type of QoS is chosen. From telephony an optimization is known, minimizing cost by choosing a subscription-type (provider), e.g., by a call-by-call prefix or user-preferences, at subscription time. Another example is the subscription-type (billing) to user-preferences in mobile communication. There is no cost reduction and no change of QoS at this moment, only billing is adapted while QoS remains.

This QoS management is of rather static type, configured administratively at subscription time. Changing the QoS and price of the subscription is an administrative task. The granularity of this approach is limited to the connection-setup, rather than the requirements of applications that use them.

This prior-art has some major disadvantages. It does not take into account the cost for operator. Effectively no change of QoS, only billing is adapted while QoS remains the same. The approaches are limited to with respect to change. Typically a user can change subscription mode 2 or 3 times. And the granularity is limited to a connection, instead of services or finer granularity. The QoS adaptation is triggered by user, based on match between preferences and behavior of the service. The user has to make the matching judgement himself.

Especially todays broadband access networks lack of dynamic subscription types. There are static subscription types dealing with the connection as a whole. Typically, at subscription-time, the user chooses a type gold versus bronze and this type is not changed thereafter. If the user wants to use demanding services, he or she will have to change his or her entire connectivity subscription impacting all services and all family members.

Figure 1 up to Figure 5 explaining the current problems and the proposed solution. For a gold service, the end-user will pay a lot of money to have, e.g. a high bandwidth available at all times, satisfying most of his needs. Although the operator will have significant revenues, he will have to provision a lot of unused bandwidth.

For a bronze service, the end-user will have a cheap subscription that will limit the networking performance. An upgrade from bronze to gold will be expensive and will be a time-consuming administrative task.

BRIEF DESCRIPTION OF THE INVENTION

The challenge is to use network resources in terms of QoS efficiently in order to satisfy the demand of customers as good as possible. In order to solve this situation one has to schedule the network resources, i.e. the QoS, with respect to the requests of the users.

The invention comprises observing resource requests and user behavior and deriving QoS demands and scheduling the network's resources in terms of QoS, accordingly. A scheduler is modulating the QoS based on service usage and user-behavior just-in-time. Modulation, here, is a varying of QoS with respect to need of QoS. From now on the term adaptation of QoS is used for QoS modulation synonymical.

User behavior is recorded based on the individual event stream and a prediction of required resources, e.g. bandwidth, delay, etc. is performed. The resources are scheduled by the expected or predicted demand accordingly. The adaptation of the QoS might be based on an analysis of user-behavior and a synthesis stored, e.g. in a user's profile. The modification of QoS settings might be made transparent to the user. The user might be involved when increasing QoS, e.g. bandwidth temporarily, and possibly pay accordingly.

The invention comprises advantageous scheduling scenarios, where the modulated QoS is triggered by service selection, where the QoS is modulated predictively, and where QoS settings are transparent to the user, and where the user is involved interactively.

OBJECTS AND ADVANTAGES OF THE INVENTION

The invention is a **Method** for efficient use of network resources by just-in-time modulation of quality of service (QoS) based on service-usage and user-behavior, a QoS user profile according to defined QoS user preferences comprising steps

- recording events at a client terminal of a user as user-behavior,
- generating a synthesis of user-behavior into the QoS user profile,
- predicting required QoS demand based on current user behavior and QoS user profile,
- deriving and propagating QoS demands and grants, and
- co-ordination of QoS demands of a manifold of users, based on QoS demands, QoS user profiles, QoS user preferences, and available resources.

The invention is also an according **Computer Software Product (client- module)** for efficient use of network resources by just-in-time modulation of QoS based on service-usage and user-behavior, handling QoS user profiles and/or QoS user preferences at a client terminal. The Computer Software Product might derive user-behavior based on recording events for a user at a client terminal and generate a synthesis for a QoS user profile. Independent it might predict the required QoS demand based on current and recorded user-behavior and/or user QoS profile information and QoS user preferences., e.g. realized by a neuronal network.

The invention is a **Computer Software Product (scheduler-module)** for efficient use of network resources by just-in-time modulation of QoS based on service-usage and user-behavior for evaluating, balancing, and propagating the QoS demands based on resource requests, QoS user profiles, QoS user preferences, and resource availability.

The invention is furthermore a **Computer Software Product (network-element-modul)** for efficient use of network resources by just-in-time modulation of QoS based on service-usage and user-behavior that serves QoS allocations and propagates QoS demands.

A **Client Terminal** is the invention, for connecting with a network comprising a QoS user profile comprising an event log reflecting resource requests and a synthesis of user behavior. The Client Terminal might comprising a QoS user preferences comprising defined QoS strategies for each dedicated service. The Client Terminal might comprising a user interface

for making the on-line (real-time) modification of QoS settings transparent to the user and means for involving the user in the decision of demanding QoS.

It is the invention to realize a **Scheduler Server** for efficient use of network resources by just-in-time modulation of QoS based on service-usage and user-behavior comprising scheduling or dispatching means for evaluating and balancing, the QoS demands and propagating the QoS grants based on resource requests, QoS user profiles, QoS user preferences, and resource availability.

The invention is also a **Network Element** for efficient use of network resources by just-in-time modulation of QoS based on service-usage and user-behavior that comprising propagating and allocating means for serving QoS grants and propagating QoS demands and QoS grants.

Further, the invention is a **Network** for efficient use of network resources by just-in-time modulation of QoS based on service-usage and user-behavior comprising at least one client terminal providing QoS demands, QoS-user-profiles, and QoS-user-preferences, at least one scheduling server providing QoS grants by evaluating, balancing QoS demands with QoS resources, and propagating the QoS demands, based on QoS user profile information and QoS user preferences, and network elements serving QoS grants and propagating QoS demands and QoS grants.

Accordingly, it is an object and advantage of the present invention adapting QoS based on a fine granularity simulate a high performant network. The adaptation reduce costs/effort for end-users and operators by using network resources efficiently.

Another advantage of the present invention is that the user has not to make the judgement about the QoS himself.

A further advantage of the present invention is that the proposed scenario has a finer granularity for QoS changes: services instead of connection, users instead of subscriber, real-time instead of only once, modulated instead of fixed.

Yet another advantage of the present invention is that end-users only pay a cheap subscription with an extra comfort service and receive a high quality user-experience, even

with this moderate subscription. Operators can dimension their networks more accurately, while generating extra revenue streams from users that normally would take cheap subscriptions.

These and many other objects and advantages of the present invention will become apparent to those of ordinary skill in the art from a consideration of the drawings and ensuing description.

BRIEF DESCRIPTION OF THE FIGURES

Figure. 1 is a schematic diagram of a prior art illustrating the problem with a Bronze QoS

Figure. 2 is a schematic diagram of a prior art illustrating the solution with a Gold QoS

Figure. 3 is a schematic drawing showing a use case diagram (according to The Unified Modeling Language User Guide, Booch et. al., Addison Wesley, 1999, Chapter 17) of the relationship between interacting components managing QoS resources and demands according to the invention.

Figure. 4 is a schematic diagram illustrating the invention where QoS is adaptive managed based on service selections.

Figure. 5 is a schematic diagram illustrating the invention where QoS is adaptive managed based on observation of user behavior and prediction.

DETAILED DESCRIPTION OF THE INVENTION

Those of ordinary skill in the art will realize that the following description of the present invention is illustrative only and is not intended to be in any way limiting. Other embodiments of the invention will readily suggest themselves to such skilled persons from an examination of the within disclosure.

Figure. 1 shows a diagram where the x-axis is time and the y axis is QoS. The bold line is the user demand for QoS, and the dashed line is the available resource of a Bronze QoS.

The textured areas mark the situations whenever the demand of QoS is greater than the available resource of QoS. The picture shows a scenario where a user starts with surfing 'surf', where the available QoS is first exceeded, then the user chats in 'chat' within the available QoS. After chatting the user starts a movie in 'movie', highly exceeding the available QoS. Additionally the user surfs in '+surf' while playing the movie. Last, the user starts a FTP session in 'ftp', also exceeding the available QoS.

The picture illustrates the lack of QoS at certain burst situations. It also illustrates the wasted QoS resource in the intermediate intervals.

Figure. 2 shows a diagram where the x-axis is time and the y axis is QoS. The bold line is the user demand for QoS, and the dashed line is the available resource of a Gold QoS.

The textured areas mark the situations whenever the demand of QoS is greater than the available resource of QoS. The picture shows a scenario where a user starts with surfing 'surf', where the available QoS is not exceeded, then the user chats in 'chat' within the available QoS. After chatting the user starts a movie in 'movie', not exceeding the available QoS. Only, when the user additionally starts surfing in '+surf' while playing the movie, the available QoS is exceeded. Last, the user starts a FTP session in 'ftp', also not exceeding the available QoS.

The picture illustrates the resolved lack of QoS at certain burst situations as shown in figure 1. It also illustrates the heavily wasted QoS resource in the intermediate intervals

Figure. 3 shows a use case diagram of the present invention. It contains a use case for the QoS scheduler 'scheduler-QoS-module', a use case covering the client functionality 'client-QoS-module', and a use case for network elements 'network-element-QoS-module'. The client use case 'client-QoS-module' is refined into a controlling use case 'QoS-preferences' and a profiling use case 'client-profiling-module', itself refined be the use cases 'QoS-profiles'. The use case 'scheduler-QoS-module' is also refined by a use case 'scheduler-profiling-module' handling multiple users' behavior. The diagram further shows an actor (User) from now on called user.

The user has a certain QoS demand, expressed in reactivity or behavior observable e.g., as resource requests or a click-stream. The use case 'client-QoS-module' has to cope with behavior and to derive required QoS demands. This might be done by recording the requests and deriving a QoS demand profile modeled by the use case 'client-profiling-module' by generating QoS user profiles, handled in the use case 'QoS-profiles'. It is taken into account that a user has the possibility to control the demanding as well as the profiling by certain preferred strategies. Therefore the use case 'QoS-preferences' is introduced.

At the network side a scheduler component is expressed by the use case 'scheduler-QoS-module'. It comprises a use case 'scheduler-profiling-module', performing aggregations of multiple QoS user profiles as well as of available QoS resources. It relates to the use case 'client-QoS-module' by 'QoS Demands'. The 'scheduler-QoS-module' use case models the activity of scheduling QoS resources with respect to QoS demands. Thus it relates to use case 'network-element-QoS-module'. The relation is named 'Grants QoS'. The use case 'network-element-QoS-module' has to provide the granted QoS to a client, accordingly, expressed by the relation 'Provides QoS' between the use case 'network-element-QoS-module' and the use case 'client-QoS-module'.

The figure shows the general working principle of the invention. At clients' side demands are derived – at network elements' side a resources are available, and the available QoS has to be allocated (dispatched or scheduled) with respect to the demands.

Figure. 4 shows a diagram where the x-axis is time and the y axis is QoS, as in figure 1 and figure2. The bold line is the user demand for QoS, and the dashed line is the available resource when the QoS is adapted based on service selection.

The textured areas mark the situations whenever the demand of QoS is greater than the available granted resource of QoS. It is assumed that enough QoS resources are available for the scenario. The picture shows the connection between the demanded necessary QoS and the granted QoS. If the demanded QoS exceeding the available QoS resources obviously a dispatching is necessary.

The picture shows a scenario where a user starts with surfing in 'surf', where the available QoS is first exceeded and after a adaptation, the demand is satisfied. When the user chats in 'chat' the necessary QoS is available. After chatting the user starts a movie in 'movie', the demand shortly is highly exceeding the available QoS. After the adaptation the demand is once more covered by the available QoS. When the user additionally surfs in '+surf' while playing the movie the same situation occurs, first exceeding available QoS, then satisfying QoS demand. The same applies when the user starts a FTP session in 'ftp'.

The picture illustrates the effect of the invention: how QoS resources are saved and how QoS demands are satisfied by an service selection based just-in-time adaptation of available QoS.

Figure. 5 shows a diagram where the x-axis is time and the y axis is QoS, as in figure 4 and figure2. The bold line is the user demand for QoS, and the dashed line is the available resource when the QoS is adapted based on observed user behavior and prediction of demand.

Here for the same user request profile as in figure 4. there is no QoS demand exceeding the available QoS. The picture illustrates the effect of just-in-time QoS adaptation based on observed user behavior and prediction: how perfectly the QoS resources are saved and how QoS demands perfectly are satisfied.

In a scenario where a modulated QoS is triggered, e.g., by service selection, the end-user will have a user-experience that is similar to the gold-subscription (see figure 2. and 4.). For the operator, this will result in a lower base-line of provisioned QoS, e.g. bandwidth, see figure 4. and 5.), with some extra bursts added. Moreover, the operator can be confident that the QoS demand will at all times map on the real needs of the end-users in contrast to the gold service. For the operator, the statistically averaged bursts combined with the accuracy of QoS demand will allow optimization of his network, both concerning design and cost. Therefore, such a service can be offered to the end-user at a more competitive price. The scenario where the QoS is modulated predictively refines the above scenario in the sense that

- more situations (surpassing the classical notion of "application") can be taken into account.
- The base-line for QoS provisioning can be lowered even further

    - lower cost for the operator
    - more bursts in QoS demand allowing the operator to dimension his network more efficiently
- the change in QoS happens just before the service actually starts, resulting in optimal transparency (no delay at start of video for example) for the end-user.
- it is optimal with respect to user experience, even going beyond a gold service.

The QoS profiles can be constructed based on the individual click-stream of and events related to the user, with the behavior of the whole user-population as a reference. The technology for establishing such profiles is already available.

The events that trigger the real-time adaptation/modulation of the QoS settings can be based on the click-stream of the user, a sequence in this stream, the launch of local applications, accessing specific URL's, accessing URL's containing a certain pattern, accessing a specific server, DNS lookups, timed events (possibly derived from the profile), predictions from comparing the profile with the entire user-population, a service that was annotated by the user as being demanding etc.

The on-line (real-time) modification of QoS settings can be transparent to the user or the user can be involved whether he agrees to increase, e.g., his bandwidth, temporarily (and possibly pay accordingly). The precise mode of operation can be chosen by the operator business model.

The invention applies in various network access scenarios.

Scenario 1: User experience & price. Apart from the obvious broadband services (internet access, gaming networks, VoIP, ...), the user subscribes to a comfort service: that promises the user the optimal bandwidth when needed. That is a optimization based on experience and cost, while reducing the QoS demand when not necessary and thus reducing price. The operator's pricing strategy can still be both flat-fee as pay-per-bit.

Scenario 2: Pro-actively upon sequence in service scenario. A system using the proposed technology can recognize the click-stream preceding a demand for high-bandwidth, e.g., the user daily browses through the same web-page to retrieve his daily news video broadcast. Even just before he asks the video, his bandwidth will be

upgraded such that at the start of the video, no delay is perceived. For the user, the experience will be exactly the same as with a very expensive gold subscription and the operator can be sure that after the video finishes, the bandwidth becomes available again.

Scenario 3: Service selection applications. Even when not surfing the web and thus not interacting with any network element or server-side software, the local click-stream can detect that the user is about to start a demanding application, e.g., a online game, ftp, net-meeting, etc. With this context knowledge it is possible to increase service selection prediction accuracy can be increased. The proposed click-stream-based technology is used to enable an on service select QoS change scenario, when the world of off-line applications suddenly needs internet connectivity.

Scenario 4: Compare user-profile with the entire user-population. Such a comparison might reveal that other users with similar profiles demand a guaranteed bandwidth when accessing a certain page, e.g. sports video's, online financial transactions, etc. The system will or can (propose to) upgrade the user experience accordingly, e.g., by even sharing network resources in the case of sports video by broadcasting.

Scenario 5: Preferences: annotate a service as requiring a high bandwidth: A system using the proposed technology can present the user with an 'increase user experience' button that marks this service as a demanding service. The user profile and preferences will be updated and the next time, the QoS will be modified even before the user starts the service.

The observing and scheduling method might comprising the following procedures . All users are observed in their use of applications and services with respect to the QoS preferences. Demands are send real-time to a central QoS scheduler or retrieved in batch mode from the logs at user side. From this behavior information orthogonal axis are synthesized in the QoS scheduler. These axis are used for definition of the input channels of a predicting component, e.g., a neural network. The neural network will be trained with the received data from the users and then installed at the user-side by the QoS scheduler.

The scheduler might work according to the following rule-chain. The error-rate is measured (prediction versus user correction) and collected through the network by the QoS scheduler for all users. The profiles of the neural networks are corrected (batch processing) through an update over the network by the QoS scheduler.

The preferences might for example comprising the following strategies each defining a granularity of scheduling

- **User demand** might be an optimization that promises the user the optimal bandwidth when needed, while reducing the QoS demand when not necessary.
- **Pro-actively** might use the event stream to predict a demand.
- **User-profile and user-population** might perform a comparison revealing that other users with similar profiles demand a guaranteed bandwidth when accessing a certain. The system will/can upgrade the user experience accordingly.
- **Static preferences** might defining a service as requiring a high QoS. The user has a preference annotate dialog for marking a service demanding certain QoS.

Alternative Embodiments

Although illustrative presently preferred embodiments and applications of this invention are shown and described herein, many variations and modifications are possible which remain within the concept, scope, and spirit of the invention, and these variations would become clear to those of skill in the art after perusal of this application.

For example, the invention can be used in a collaborative distributed environment. That means the scheduler functionality as well as the client functionality and network element functionality might be realized as a distributed system. For the readers convenience the decomposition is described in a hardware centric fashion binding functionality to network nodes, i.e., hardware entities. It might be preferable to enhance certain network management components or even to distribute components over the network as mobile agents. The shown architecture is for illustrating purposes, only.

The invention, therefore, is not intended to be limited except in the spirit of the appended claims.

CLAIMS

What is claimed is:

1. A The **Method** for efficient use of network resources by just-in-time modulation of quality of service (QoS) based on service-usage, user-behavior, and a QoS user profile according to defined QoS user preferences comprising steps

- recording events at a client terminal of a user as user-behavior,
- generating a synthesis of user-behavior into the QoS user profile,
- predicting required QoS demand based on current user behavior and QoS user profile,
- deriving and propagating QoS demands and grants, and
- co-ordination of QoS demands of a manifold of users, based on QoS demands, QoS user profiles, QoS user preferences, and available resources.

2. A **Computer Software Product (client- module)** for efficient use of network resources by just-in-time modulation of quality of service (QoS) based on service-usage and user-behavior handling QoS user profiles and/or QoS user preferences.

3. The **Computer Software Product (client-module)** according to claim 2. where user-behavior is derived based on recording events (resource requests) for a user and a synthesis for a user QoS user profile is generated.

4. The **Computer Software Product (client-module)** according to claim 2. where the required QoS demand is predicted based on current and recorded user-behavior and/or user QoS profile information and QoS user preferences.

5. The **Computer Software Product (client-module)** according to claim 4. where a prediction is realized by a neuronal network.

6. A **Computer Software Product (server-module)** for efficient use of network resources by just-in-time modulation of QoS based on service-usage and user-behavior for evaluating, balancing, and propagating the QoS demands based on resource requests, QoS user profiles, QoS user preferences, and resource availability.

7. A **C mputer Softwar Product (netw rk-element-modul)** for efficient use of network resources by just-in-time modulation of quality of service (QoS) based on service-usage and user-behavior that serves QoS allocations and propagates QoS demands.

8. A **Client Terminal** for connecting with a network comprising a quality of service (QoS) user profile comprising an event log reflecting resource requests and a synthesis of user behavior.

9. The **Client Terminal** for connecting with a network comprising at least one QoS user preferences comprising at least one QoS demanding strategy.

10. The **Client Terminal** for connecting with a network comprising a user interface for making the on-line (real-time) modification of QoS settings transparent to the user and means for involving the user in the decision of demanding QoS.

11. A **Scheduler Server** for efficient use of network resources by just-in-time modulation of quality of service (QoS) based on service-usage and user-behavior comprising scheduling or dispatching means for evaluating and balancing, the QoS demands and propagating the QoS grants based on resource requests, QoS user profiles, QoS user preferences, and resource availability.

12. A **Network Element** for efficient use of network resources by just-in-time modulation of quality of service (QoS) based on service-usage and user-behavior that comprising propagating and allocating means for serving QoS grants and propagating QoS demands and QoS grants.

13. A **Network** for efficient use of network resources by just-in-time modulation of quality of service (QoS) based on service-usage and user-behavior comprising at least one client terminal providing QoS demands, QoS-user-profiles, and QoS-user-preferences, at least one scheduling server providing QoS grants by evaluating, balancing QoS demands with QoS resources, and propagating the QoS demands, based on QoS user profile information and QoS user preferences, and network elements serving QoS grants and propagating QoS demands and QoS grants.

ABSTRACT

The invention relates to observing requests, deriving quality of service (QoS) demands and scheduling the network's resources in terms of QoS. A scheduler is modulating the QoS based on service usage and user-behavior just-in-time. It relates to a method for efficient use of network resources by just-in-time modulation of quality of service based on real-time service-usage and user-behavior comprising steps recording events, generating a synthesis of user-behavior for a QoS user profile according to QoS user preferences, predicting required QoS demand based on current user behavior and user QoS profile, according to QoS user preferences, deriving and propagating QoS demands and allocations, and co-ordination of QoS request of a manifold of users, based on requests, QoS user profiles, QoS user preferences and resources. Further it relates to Computer Software Product, Client Terminals, a Scheduler server, a Network Element, and a Network.

Figure 4.

FIGURES

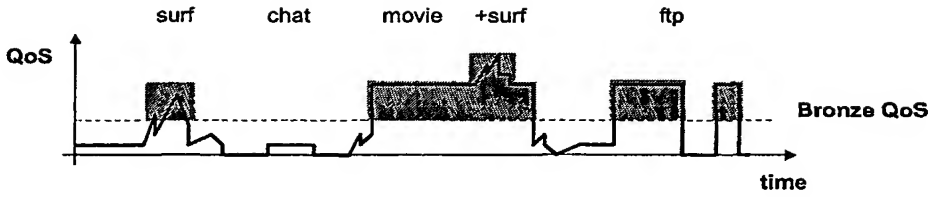

Figure 1.

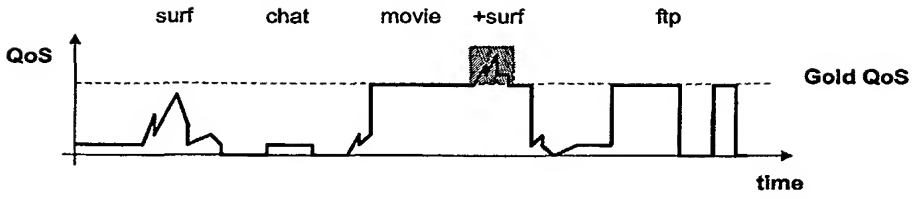

Figure 2.

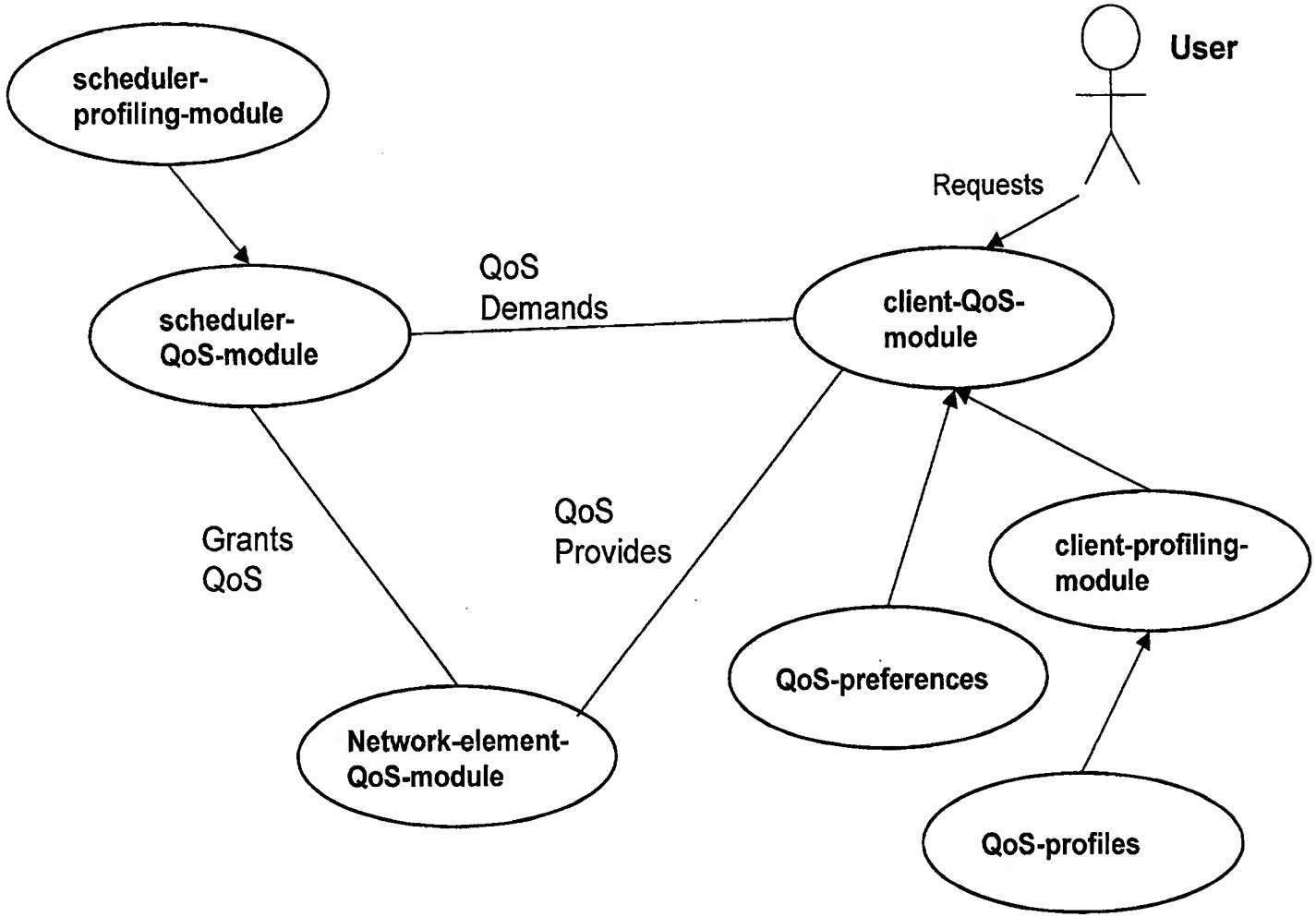
scheduler-profiling-module
User
Requests
QoS Demands
scheduler-QoS-module
client-QoS-module
Grants QoS
QoS Provides
client-profiling-module
QoS-preferences
Network-element-QoS-module
QoS-profiles

Figure 3.

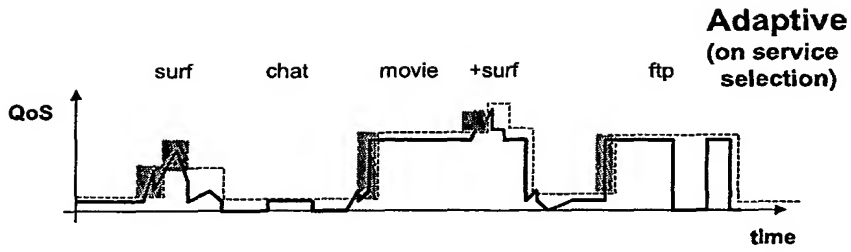

Figure 4.

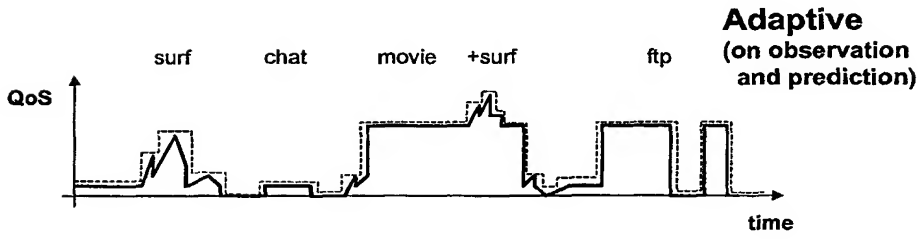

Figure 5.